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MOUNTAIN PINE BEETLE IMPACT SURVEY NINEMILE DRAINAGE, LOLO NATIONAL FOREST, AND STATE AND PRIVATE LANDS, MONTANA 1973

by

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ABSTRACT

The mountain pine beetle reached epidemic levels in second-growth 80-year-old ponderosa pine stands on the Ninemile Ranger District in 1969. The outbreak increased through 1971 and spread over 30,000 acres. Heavy infestation occurred on about 2,600 acres within this area. A two-stage survey was used during 1972 and 1973 to stratify the infestation, and obtain tree and volume loss estimates. This survey shows that about 109,284 trees were killed with an estimated volume loss of 613,743 board feet from 1970 to 1973. The outbreak has been declining since 1971. Surveys this year point toward a continued decline. However, some "hot spot" infestations will persist in pure, overstocked, second-growth stands. Commercial thinning is encouraged to release the stand, promote tree growth, and change the microenvironment, making it unattractive to mountain pine beetle.

INTRODUCTION

The mountain pine beetle, *Dendroctonus ponderosae* Hopk., is a serious bark beetle pest of second-growth ponderosa pine throughout many forested areas of the western United States (Wortendyke, 1968; Sartwell, 1971; Bousfield et al., 1973). Outbreaks appear in overstocked, stagnated, second-growth stands in the 60- to 80-year age class. Infestations usually reach epidemic levels rapidly, and continue for several years. Tree killing appears to be indiscriminate, with trees of all diameter classes being attacked.

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EXPERIMENT STATION

The mountain pine beetle infestation in the Ninemile drainage began in 1969. Although groups of infested trees are scattered over 30,000 acres, only 2,600 acres are within the heavy infestation zone. Surveys in 1972 show that the majority of infestation occurs on State and private lands, with a lesser amount on National Forest lands within the Ninemile drainage.

The infestation was evaluated in 1972 and again in 1973 to inventory tree and volume losses that have occurred during this outbreak.

SURVEY METHODS

The 1973 survey was essentially patterned after the survey in 1972. Photographs were taken by Engineering, Missoula, Montana, in May, instead of September, on a 9-inch format with a Zeiss RMKA 15-23 aerial camera equipped with a 6-inch focal length lens. The film was Ektachrome MS Aerographic 2448 color positive. One level of photography was taken at a scale of 1:6000 in stereo pairs, from which the photo counts were made.

Individual interpretations were made on nine ½-acre circular plots numbered sequentially on each stereo pair. Interpretations were made on a total of 323 ½-acre plots within the infestation. Twenty ½-acre plots were selected from the 323 plots using the computer program PPSORT for ground cruising (Stage, 1971). Within each plot, all trees 5 inches d.b.h. and larger were tallied and recorded as to species, diameter (d.b.h.), and total height. Ponderosa pines in each plot were classed into one of the following five tree classes:

0 = green, uninfested
1 = attacked 1973; fading, containing brood
2 = attacked 1972; brood emerged, needles red
3 = attacked 1971 or prior; majority of needles dropped
4 = Pitchout; pitchtubes, green crown, no brood

Field data were analyzed by a modified ADP timber sale cruise program. Results from this analysis provided the input of tree and volume estimates by year which were then entered into the PPSORT analysis to provide total tree and volume loss estimates.

The ground survey was conducted during December 1973; and a total of nineteen ½-acre plots were surveyed.

RESULTS

Survey results show that the mountain pine beetle has killed an estimated 613,743 board feet of second-growth ponderosa pine on about 2,600 to 3,000 acres since 1970. Estimated tree and volume losses are shown in Table 1.

Table 1.--Estimated tree and volume losses, Ninemile Ranger District, Lolo National Forest 1970-1973

Year	Total trees killed	Total volume loss
1970	50,836	331,651
1971	46,280	146,112
1972	9,048	106,860
1973	3,120	29,120
TOTAL	109,284	613,743

The infestation has steadily declined since 1970. However, "hot spot" infestations do persist in heavily stocked stands. Several hundred newly attacked trees occur in scattered groups over about two sections of land around Lost Lake in the upper Ninemile drainage. Examination of these stands in March 1973 showed that the majority of infested trees were heavily woodpeckered. We believe direct feeding, larvae dropping to the ground, and desiccation will result in high brood mortality, and probably will result in a reduction in the number of infested trees in this area.

Infested trees averaged 7.2 inches d.b.h. in 1971 (range 6 to 10 inches), 7.6 inches d.b.h. in 1972 (range 7 to 17 inches), and 8.1 inches d.b.h. in 1973 (range 5 to 40 inches). A breakdown of mortality and volume loss per acre is shown in Table 2.

Table 2.--Estimated tree and volume losses/acre Ninemile District, Lolo National Forest, 1971-1973

Year	Number of trees killed/acre		Volume Loss/Acre	
	Average	Range	Average	Range
1971	47.8	2-117	272	12-1,240
1972	25.2	1-152	140	1-360
1973	4.6	1-23	39	7-167

Because the PPSORT program selects plots in proportion to size, most plots fell in areas containing a majority of 1972 and older faded trees. To check equal probability selection an additional 20 ½-acre plots were randomly selected to survey. The majority of the stand in these plots showed only a few faded trees. However, the random selection did choose three plots that were previously surveyed in December. Results comparing number of infested trees/acre from the two surveys are shown in Table 3.

Table 3.--Comparison of estimated infested trees/acre between random selection and PPSORT selection

Year Infested	Random Selection trees/acre	PPSORT Selection trees/acre
1972	3.3 ± 38.94%	3.4 ± 27%
1973	2.6 ± 84.4%	1.2 ± 28%

Sampling error was higher on the random selection than on plots selected proportional to size.

DISCUSSION

The mountain pine beetle has caused extensive mortality in overstocked second-growth ponderosa pine stands in the Ninemile drainage since 1969 (Ciesla and McGregor, 1970; Ciesla et al., 1970; McGregor, 1973; Bousfield et al., 1973).

This outbreak did not build up slowly over a period of years as do most mountain pine beetle outbreaks, rather it developed rapidly, and several thousand fading trees were mapped during the annual insect and disease detection survey during fall 1969. As these outbreaks start, about five to 10 trees per acre are killed, and group kills of three to five trees are common. These occur scattered over a wide area. Then in successive years, the number of infested trees increases to a peak level of about 30 to over 50 infested trees/acre.

In Oregon, under essentially the same habitat type, stand conditions, and elevation, past outbreaks of this type are associated with overstocked stands. Ponderosa pine stands in overstocked condition generally are more susceptible to attack by mountain pine beetle (Sartwell, 1971).

The relation of beetle-caused mortality to stand density is believed to occur because overcrowding reduces the vigor of ponderosa pines and allows the beetle to kill a larger proportion of trees in a dense stand than in a sparse one.

In Oregon, Sartwell (1971) found that effect of site quality upon the character of tree killing was quite marked. In the site class III stand, or poorer stands, mountain pine beetle-caused mortality constituted a natural thinning from below. In site IV stands, tree killing is usually indiscriminate. In site V stands (about 120 basal area) beetle-caused tree mortality was a thinning from above, or a killing of the larger diameter trees. The general level of mortality was higher on poor sites than on good ones.

Stands in the Ninemile area average about 70 years old. Dense even-aged stands, such as those that occur in the Ninemile area, provide the type of situation in which severe infestations of mountain pine beetle are becoming more common in second-growth ponderosa pine stands in the western United States.

According to Graham (1956) some insect outbreaks are spectacular applications of the "law of natural compensations." Graham contended that this law operates in all tree populations but is enforced more conspicuously in unstable forests. A characteristic of insects enforcing this law is that they seldom become outbreak in climax forests but frequently do where stand stability is disrupted by nature or man. Available historical evidence indicates that mountain pine beetle plays a compensating role in the ponderosa pine ecosystem of the Pacific Northwest Region (Sartwell, 1971), and he further states that recent outbreaks can be viewed as natural consequences of human influences upon pine ecology.

This indicates that the killing of beetles by such methods as spraying infested trees with toxic chemicals, or felling and burning infested trees will provide only temporary relief from damage, because the beetle will tend to build up rapidly again as long as stand conditions are not improved.

It also indicates that beetle impact can be reduced by silvicultural treatments which (1) maintain or restore diverse stand structure, and (2) control pine stand density at levels below which tree killing is economically tolerable. Thus, thinning of dense stands should generally be the first line of defense against the mountain pine beetle problem in ponderosa pine.

CONCLUSIONS

Mountain pine beetle appears to be decreasing in the Ninemile drainage. Some "hot spot" infestations persist, and the majority of these are in the more heavily stocked pure stands. Newly attacked trees are sparce in areas where heavy infestation has persisted for 3 to 4 years.

As a result of beetle surveys conducted in the Ninemile drainage, the Ninemile Ranger District has thinned one 633-acre block in the Isaac Creek drainage. This block was precommercially thinned during spring 1971. There were three infested trees per acre prior to thinning. Post-thinning surveys show an average of 0.2 infested trees/acre. Stocking levels were reduced from 294 trees/acre prior to thinning to 167 trees/acre since thinning. In this block, the remaining green stand is 42.8 percent ponderosa pine, 54.6 percent Douglas-fir, and 2.4 percent western larch. Surveys of this stand will continue through 1975.

FUTURE PLANS

District personnel have planned additional commercial thinnings in three areas in the Ninemile drainage. A summary of these areas follows:

HOULE CREEK INTERMEDIATE

Location: S½ Section 7 and SE¼ Section 8, T. 15 N., R. 21 W.

Acres to be cut: 247

Purchased by: Intermountain Company

Cut Volume Summary

Total volume: 1.133 MMBF
Volume per acre: 4.6
Total trees: 22,016
Trees per acre: 89
Average d.b.h.: 10 inches
Average height: 61 feet

Leave Volume Summary

Total volume: 0.848 MMBF
Volume per acre: 3.4
Total trees: 10,741
Trees per acre: 43
Average d.b.h.: 12 inches
Average height: 67 feet

Silvicultural Description

The stand type is Douglas-fir/ponderosa pine, 75 years old, manageable; and average growth rate is about 1.6 inches/10 years. Habitat type is Douglas-fir/ninebark. There is poor stocking of overmature Douglas-fir and ponderosa pine overstory.

Objective is to thin stand to spacing of 18 to 22 feet and remove all overstory. Cutting should be done from September through March and the slash treated progressively to limit the potential for pine engraver beetle *(Ips pini)*. Mountain pine beetle is causing some mortality in this area. Prethinning surveys show an average of 1.5 infested trees/acre. Infested trees average 5 inches d.b.h. which is relatively small. Pine engraver beetle could be top killing many trees, then the mountain pine beetle could be attacking in the lower bole. It is expected that the beetle will move into larger diameter trees in successive years.

The cutover area will be precommercially thinned to supplement the commercial thinning. The thinning prescription is 20- by 20-foot spacing to maintain approximately 110 crop trees per acre.

Slash Plan

The purchaser will be required to tree-length skid and progressively burn tops at landings. There will be an estimated 17 landings.

EDITH INTERMEDIATE

Location: Section 22, T. 15 N., R. 21 W.
Acres to be cut: 185
Purchased by: Intermountain Company

Cut Volume Summary

Total volume: 1.026 MMBF
Volume per acre: 5.8 MBF
Total trees: 18,219
Trees per acre: 102
Average d.b.h.: 10 inches
Average height: 65 feet

Leave Volume Summary

Total volume: 1.015 MMBF
Volume per acre: 5.7 MBF
Total trees: 9,241
Trees per acre: 52
Average d.b.h.: 13 inches
Average height: 72 feet

Silvicultural Description

The stand is Douglas-fir/ponderosa pine, 75 years old, manageable; and average growth rate is about 1.0 inch/10 years. Habitat type is Douglas-fir/ninebark. There is poor stocking of overmature Douglas-fir and ponderosa pine overstory.

Prethinning surveys show no infested trees occur in this block.

Stand is to be thinned with an 18- to 22-foot spacing and all overstory is to be removed. Cutting should be done from September through March and the slash treated progressively to limit the potential for pine engraver beetle (*Ips pini*).

The cutover area will be precommercially thinned to supplement the commercial thinning. The thinning prescription is 20- by 20-foot spacing to maintain approximately 110 crop trees per acre.

Slash Plan

The purchaser will be required to tree-length skid and progressively burn tops at landings. There will be an estimated 11 landings.

ROMAN CREEK INTERMEDIATE

Location: NE¼ of section
Acres to be cut: 158

Cut Volume Summary

Total volume: 1.067 MMBF
Volume per acre: 6.7 MBF
Total trees: 17,512
Trees per acre: 110
Average d.b.h.: 11 inches
Average height: 66 feet

Leave Volume Summary

Total volume: 1.024 MMBF
Volume per acre: 6.5 MBF
Total trees: 8,076
Trees per acre: 51
Average d.b.h.: 13 inches
Average height: 74 feet

This sale has not been sold yet because there is a problem in getting the right-of-way to log this isolated unit.

This stand consists of manageable Douglas-fir/ponderosa pine. The habitat type is Douglas-fir/snowberry. There is poor stocking of overmature Douglas-fir and ponderosa pine overstory.

Objective is to thin stand to spacing of 18 to 22 feet and remove all overstory. Cutting should be done from September through March and the slash treated progressively to limit the potential for pine engraver beetle *(Ips pini)*. Prethinning surveys show an average of 0.9 infested tree per acre. Infested trees average 8 inches d.b.h.

The cutover area will be precommercially thinned to supplement the commercial thinning.

The thinning prescription is 20- by 20-foot spacing to maintain approximately 110 crop trees per acre.

Slash Plan

The purchaser will be required to tree-length skid and progressively burn tops at landings.

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